THE BIG 5 International Building & Construction Show

5 - 8 DECEMBER 2022
DUBAI WORLD TRADE CENTRE

FM DATA AND TECHNOLOGY

FERGUS REGAN

FM IN THE BUILT ENVIROMENT /DATE/TECHNICAL MANAGER

Facility & Asset Management

- International companies delivering FM services
- Asset management delivered by experts in their field
- Facility Management market continues to develop and grow.
- The Market is competitive. Low margin, High volume business
- FM Key Success factors
  - Listening to our Customers
  - Customer service excellence
  - QHSE compliance
  - Energy, Environment & Sustainability
  - Innovative solutions
  - Adopting latest technology
  - Workforce engagement
  - Continuous improvement
  - Etc.

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Talks Urban Design & Landscape

THE BIG 5

The following presentation shall cover some of the Technical systems employed around asset management and use of technology

- SAFETY COMPLIANCE
- ASSET MANAGEMENT
- MAINTENANCE STRATEGY
- RISK BASED MAINTENANCE
- CONDITION MONITORING
- TECHNOLOGY
- TRAINING
- ETC

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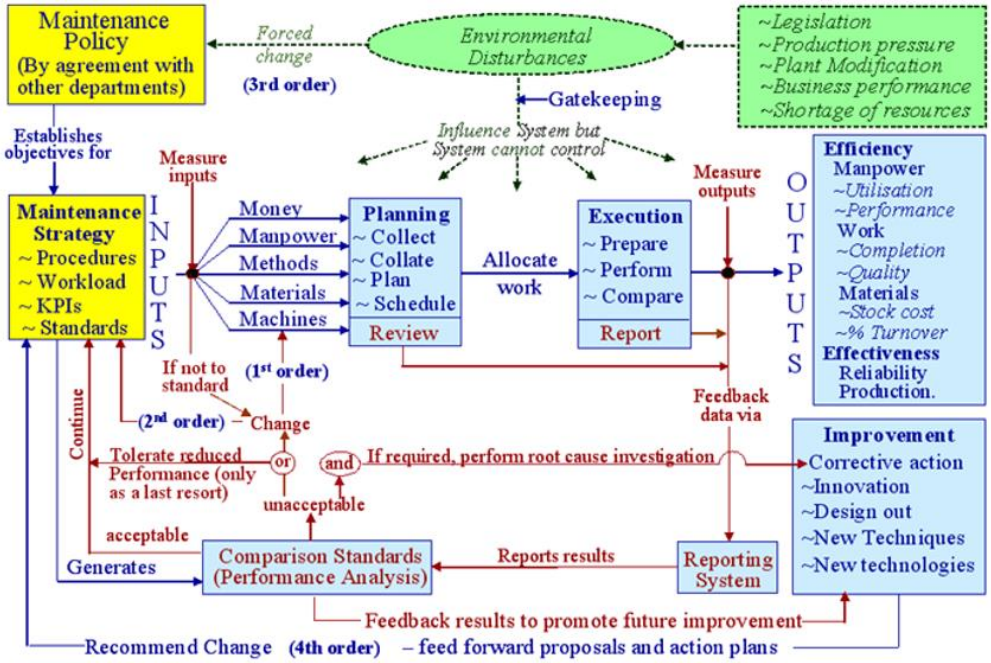
Asset Stewardship – A Holistic Process



THE BUSINESS NEED

EXCELLENT CUSTOMER SERVICE and a MAINTENANCE POLICY aligned to the business goals & objectives.

Typical elements below.

- MAINTENANCE STRATEGY
- SAFETY AND LEGAL COMPLIANCE
- ENVIRONMENT AND SUSTAINABILITY GOALS
- RISK BASED ASSESSMENTS
- ENGINEERING BEST PRACTICE
- INNOVATIVE SOLUTIONS
- DATA DRIVEN DECISION MAKING
- CONTINUOUS IMPROVEMENT
- EFFECTIVENESS AND EFFICIENCY

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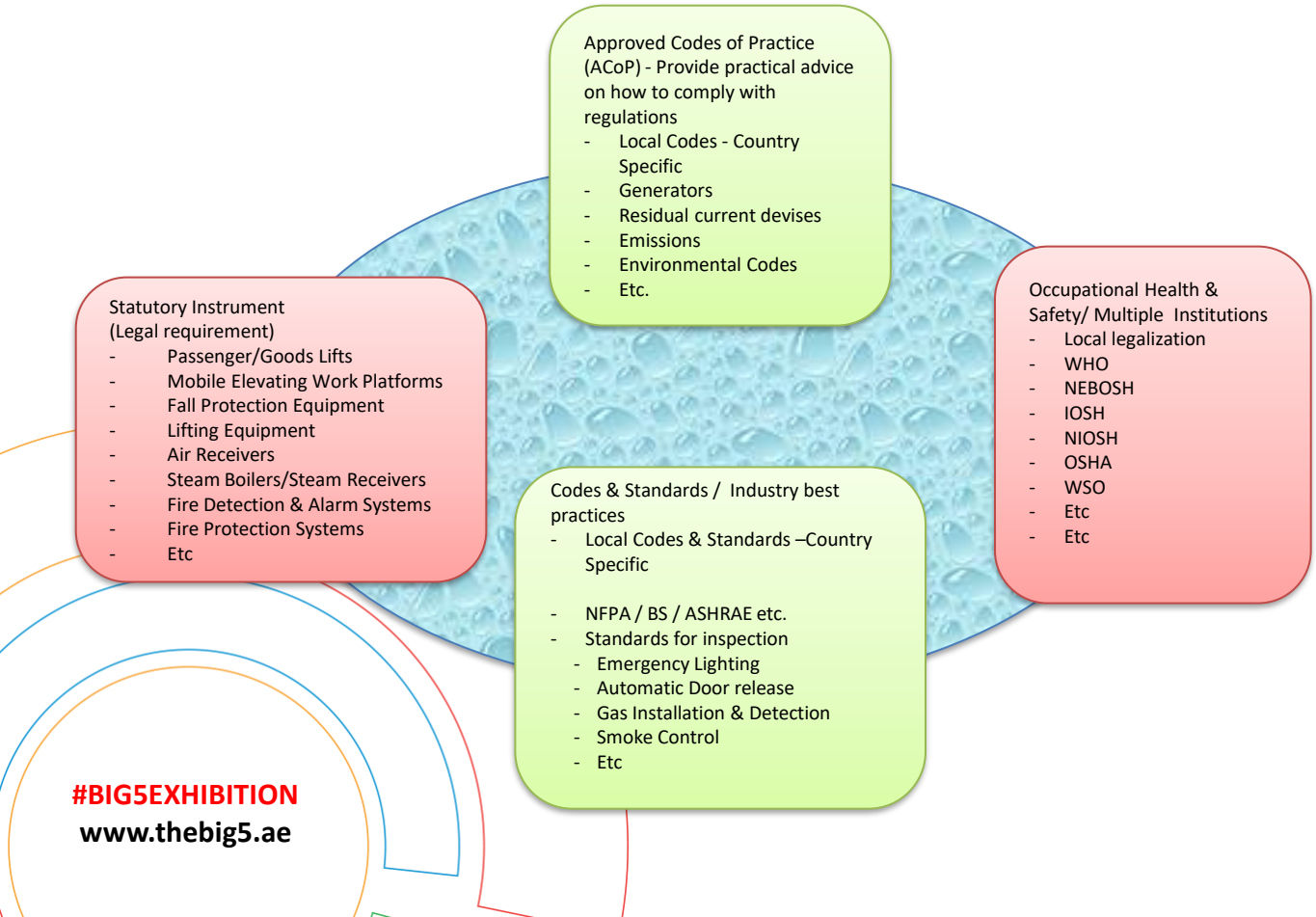
Safety & Regulatory Compliance



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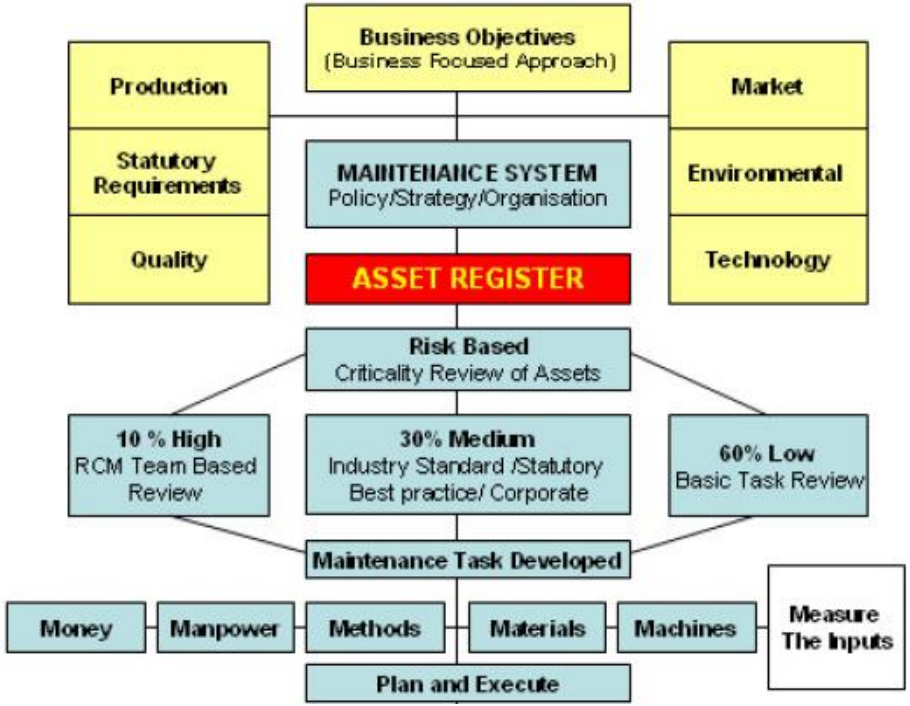
FM/O&M

As part of maintenance and operations, Each Company must comply with the applicable, codes and standards, and follow industry best practices.

SAFETY SUMMARY

- Statutory Inspections
- Industry Standards
- ACoP (Approved Codes of Practice)
- OHS

Asset Register risk-based review of Plant Criticality



CONDUCT RISK BASED REVIEW OF THE ASSET REGISTER TO IDENTIFY HIGH, MEDIUM AND LOW PRIORITY PLANT

HIGH PRIORITY CRITICAL PLANT MAY REQUIRED DETAILED REVIEW OF THE REQUIRED MAINTENANCE

Medium priority plant will follow normal standards and safety requirements

Low priority plant may require less frequent review

Structured Process Evaluation Tools & Systems

IMPROVEMENT PROCESSES	Description - Short version	Basic note on their application
RCM	Reliability Centered Maintenance Looks at the consequence of failure under the headings of Hidden failures, Safety & Environmental, Operations & Non-Operations.	Excellent for complex systems, utility equipment failure mode analysis. System developed in 1960, and revolutionised the Aircraft industry, by improving relaibility
FMECA	Failure mode effects and criticality analysis. How does the equipment, process fail and what is the effect of this failure.	Failure mode effects and criticality analysis (FMECA) is a quantitative analysis applied to systems in order to determine the consequences of failure, as well as the probability of such failures.
TPM	Total Productive Maintenance is a holistic approach to equipment maintenance that strives to achieve perfect production:	Pillars of TPM: Autonomous Maintenance, Process & Machine Improvement, Preventative Maintenance, Early Management of New Equipment, Process Quality Management, administrative Work, Education & Training, Safety & Sustained Success.
6-Sigma	Can be used for Management, Production, Maintenance for improving efficiency	Can be used for manufactoring, production, and project management
Lean Manufacturing	LEAN five principles for improving workplace efficiency 1) defining value, 2) mapping the value stream, 3) creating flow, 4) using a pull system, and 5) pursuing perfection.	Aims to reduce waste and inefficiency in the management of physical assets. Combines a mix of other imporovement processes.
Kaizan	Teamwork,personal discipline,improved morale,quality circles,suggestions for improvement)	Kaizen is a Japanese term meaning change for the better or continuous improvement.
5S	5S model emphasizes structure, order, cleanliness, standardization and a disciplined approach to sustaining the process. (Sort, Set up order, Shine, Sstandardize, Sustain)	5S and Kaizen are related in the fact that they are both concepts used in Lean manufacturing
Many others exist	---	---

EVALUATION TOOLS

There are many process tools to chose from. Each process have their own merits, each providing structured approach to manage operations.

RCM
Is a risk-based process with a focus on determining consequence of failure, in order to select appropriate maintenance strategy.

Whereas TPM
focuses on autonomous teams, visual aids, OEE, score boards,.. etc

Etc.

You can use a combination of systems, based on your specific site needs

Reliability Centered Maintenance

Reliability Centered Maintenance (RCM) is a methodology that is used to determine

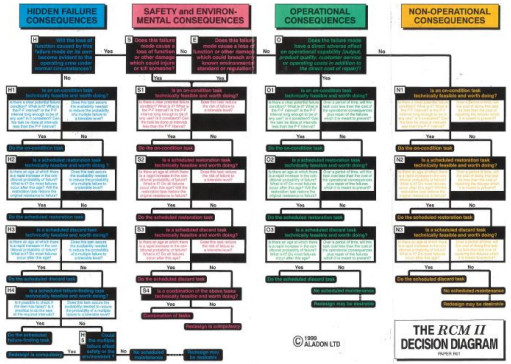
The right maintenance task to ensure that that the physical asset or system continues to maintain the function that the client requires, in its present operating context.

Generally, once a system is identified for RCM study, the components of the system are mapped out, and questions answered as to how the part or system function loss may occur.

Typically, how can the part produce too much, too little or none at all?

RCM TEMPLATE EXAMPLE

RCM II Information Worksheet		Sistem : UNIT PEMBANGKIT LISTRIK TENAGA UAP		*Unit 4 UP Gresik*	
			1	*SUPERHEATER*	
Function		*Function Failure*	*Failure Mode*		*Failure Effect*
1	Transform saturated steam to super heated steam that is exhausted from the high pressure steam drum	1	1	Cracked drain inlet primary superheated boiler pipe	Cracked pipe caused by corrosion and unable to withstand the heat when the combustion process is on. If the pipe is cracked can cause shutdown and trip.
			2	Leaked secondary superheated inlet header drain valve	Super heated steam formation process cannot be done properly and may cause shutdown
			3	Leaked final superheater inlet header valve	Super heated steam formation process cannot be done properly and may cause shutdown
			4	Obsolete and degrading pipes	Corrotion and deposit happen because overload of several compound into the pipes, which are Na, Mg, Cl. The pipes become easily broken. Aside from that the mixing of the compound and the superheated steam can cause trip.



RCM DECISION MAKING TREE

RCM provides a structure process to review risks under safety & environment, operation, non-operational and hidden consequences.

Hidden failures means failure that will only be evident after its fails.
Such items must be tested periodically!
(Examples: High Pressure Shut Down sensor, Fire Alarm sensor…)

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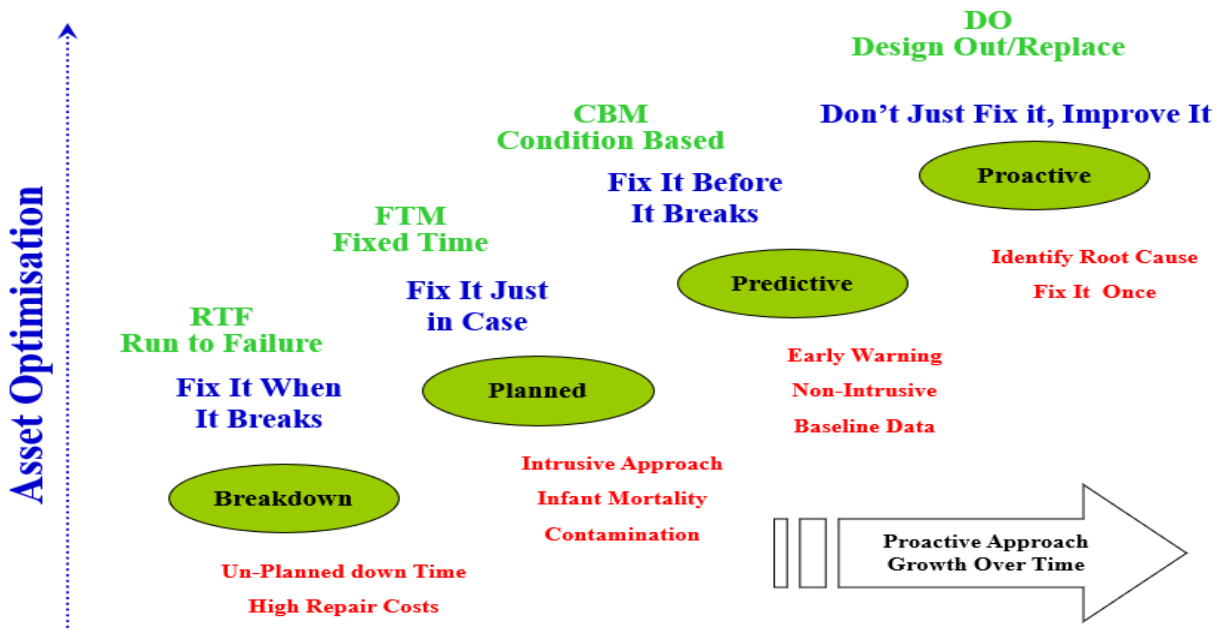
Maintenance Type – Select as appropriate



Maintenance Strategy will be a combination of the Above

Types:

- Breakdown (Most costly)
- Planned
- Predictive
- Proactive (Best)

If no consequence to failure, then possible to use run-to-fail maintenance strategy

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CONDITION BASED DATA & TECHNOLOGIES

Talks Facilities Management

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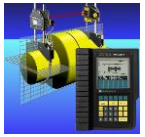
Ultrasonic Leak Inspection

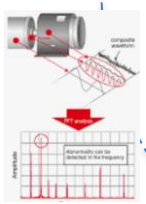
Building Management Systems (BMS)

- Automatic Alarms
- Trend Analysis
- Energy Meter Consumption Data
- LEED Reporting
- **AI** prediction programs



Laser Shaft Alignment

Vibration Analysis



Borescope

Computerize Maintenance Management System (CMMS)

- Planned, Reactive, Run Time Based Maintenance
- Plant History
- Process Parameter Inspection

Thermography

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Condition Based Tools – Possible Site Applications

PdM Technologies and their Relevance to YOUR Site Systems	Med / High	Matricx of Potential Condition Based Technologies against YOUR SITE Systems Is PdM Approcah Benifical OR Justified?- Critical Systems - Use RCM/FMECA Risk Based Analysis of plant function										
SITE SYSTEMS	PROCESS PARAMETER TRENDING (PI/BMS)	FILTER Monitor Delta P	THERMAL IMAGING	HEPA FILTER TESTING	PARTIAL DISCHARGE	YIBRATION ANALYSIS	FAN BALANCE	LASER ALIGNMENT	ULTRASOUND - Steam Trap Inspection	ULTRASOUND - LEAK Inspection - Air/Gas	BOROSCOPE	NDT Testing Tickness/Mag Part/Flours)	Oil Analysis Sample Analysis
ELECTRICAL - SWITCHGEAR	High		High		High								
ELECTRICAL- TRANSFORMERS	High		High		Med								
CHILLERS / COOLING TOWERS	High		Med			High							High
COOLING TOWERS - FANS	Med					High	High	High					
STEAM BOILERS	High		High			Med				Med		Med	
STEAM TRAPS, CONDENSATE SYSTEMS	Med		High						High	High			
COMPRESSED AIR SYSTEMS	High					High				High			High
HVAC SYSTEMS - FANS / MOTORS	Med	High	High	High		High	High	Med					
PROCESS PUMPS / MOTORS	High					High		High					
TANK INSTALLATIONS	High											High	
PIPE SYSTEMS	Med									High	Med	Med	

SIMPLE MATRIX

- Critical Plant identified
- RCM analysis conducted
- Review opportunities for condition monitoring application for your plant.
- Fill out table where condition monitoring technology can be applied.

NEW SITE - OPPORTUNITY

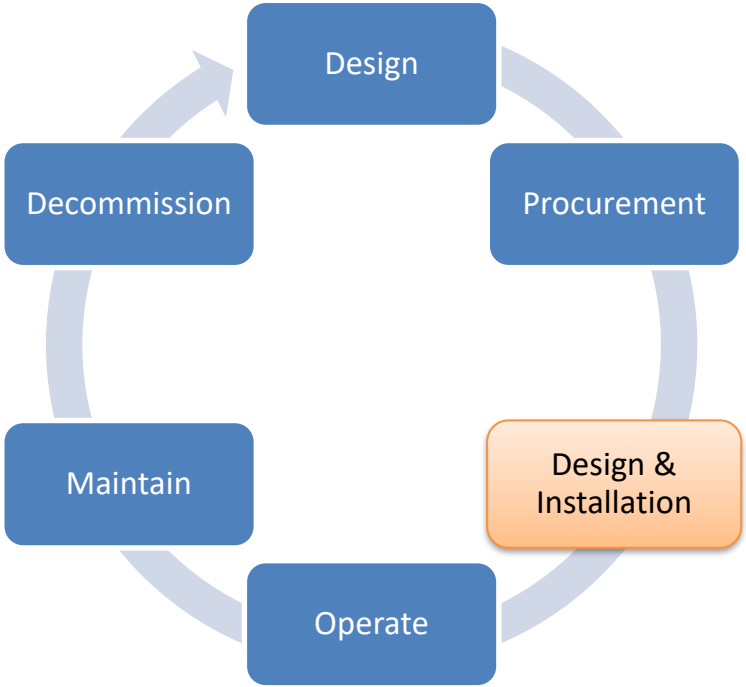
- Design in Condition Monitoring
- Include in specifications
- Install TI Windows, Vibration Sensors etc.
- Laser Align Pumps
- Use for plant acceptance
- Baseline recorded

CAPITAL INVESTMENT - ROI

System pays for itself. Plant accepted against defined condition Standards.

Life Cycle Costs

Design for maintainability at the start



- > 80% of costs realized over the life cycle are directly related to the design & installation
- Processes need to be addressed at the front end
  - New Equipment Specs
    - Accessibility
    - Standard Parts
    - Maintainability
  - ID Critical Spares
  - PM Development
  - Training

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STAFF DEVELOPMENT – SAMPLE TRAINING LIST

Category	Institutes / Technical Training Course / Certification	Levels
LEED	LEED Green Associate (GP)	--
LEED	LEED Accredited Professional	--
Energy	Energy Management Standard - ISO 50001	--
Energy	Certified Energy Manager (CEM)	--
Energy	Certified Automation Engineer (CAM)	--
Energy	ASHRAE Energy Auditing	Level 1, 2, 3
Project Management	Project Management Professional (PMP)	--
Reliability	Society for Maintenance & Reliability Professionals (SMRP)	--
Reliability	Reliability Centered Maintenance (RCM)	--
Reliability	ARMS - Reliability Engineer Training	--
Thermography	Infra-red Acadamey for Thermographers	Level 1, 2, 3
Vibration Analysis	Vibration Analysis Courses	Level 1, 2, 3
Ultrasonic Inspection	Ultrasonic Inspection Techniques	--
Etc	--	--

The job of the maintenance practitioner is to solve problems daily.

Multiple training7 courses are available on-line with recognized certification.

Investigations, Root cause analysis need to be based on real data.

Important to engage , support staff as part their continuous development

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SUMMARY

- Design your plant for Maintainability and to reduce LCC
- Need to understand the Business Goals and Objectives
- Align the maintenance strategy to the business
- Comply with Heathy and Safety requirements
- Build and Maintain an accurate Asset Register
- Conduct risk-based maintenance reviews - Identify plant criticality
- Use the appropriate evaluation tools based on plant criticality – RCM, FMECA etc.
- Select Maintenance Type suitable to the equipment
- Utilize condition based data, inspections and technologies where appropriated
- CMMS, BMS are critical for plant history, data, consumption, trend analysis and energy management.
- Incorporate condition-based technologies into the design build for best return on investment
- Engage and develop staff in problem solving ability, root cause using real data and inspection techniques

Know what is critical to the business

Conduct Risk based reviews

Design your maintenance strategy accordingly

Design in Maintainability

Condition based Real-data used

Train and engage your staff

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